



T0123-P Microgravity propellant gauging using modal analysis

Problem Statement

- Propellant mass gauging currently requires settling burns or pressurant hardware.
- Modal Mass gauging has been characterized in lab and settled, 1-g gauging resolution has been established. FOP flights will yield data on gauging resolution for unsettled fuel states in zero-g.
- MPG experiment tracks acoustic resonances in propellant tanks. Peaks shift with changing liquid volume.
- Potential users include commercial launch vehicles, life support and habitation systems.

Technology

Development Team

- Project PI: Kevin Crosby, Carthage College, kcrosby@carthage.edu.
- Funding provided by NASA USIP Grant and WSGC.
- Partners: Rudy Werlink, KSC Cryogenics Lab.

Proposed Flight Experiment

Experiment Readiness:

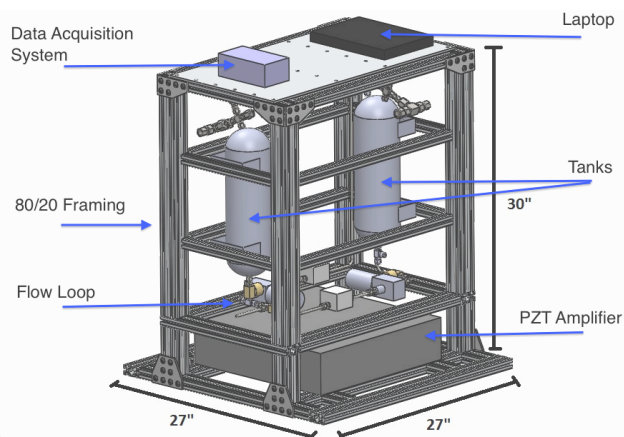
- MPG Experiment will be ready for parabolic flight testing by June, 2014.

Test Environment:

- Previous tests aboard parabolic flights yielded preliminary data on gauging resolution and demonstrated proof-of-concept. A sounding rocket flight yielded data on settled fuel states in small tanks.

Test Apparatus Description:

- The test rig measures 27"x27"x30" and weighs approximately 86 kg. Rig consists of two experimental tanks, a flow loop, and a data acquisition system. Operator interface will be via a laptop computer running a *Labview* user interface.



Technology Maturation

- Current TRL of MPG Experiment is 3-4. For advancement, we require demonstrated consistent 1.5% resolution in gauging fill levels between 30%-70% across different tank geometries and sizes.
- Advance technology maturation through low-g flights with two different tank sizes; characterize power requirements for large-scale tank propellant gauging.

Objective of Proposed Experiment

- Measure modal mode peak positions at 1% fill intervals.
- Expect experiment to provide modal gauging resolution data. This is the second tank tested on parabolic flights and so will address question of universality of technique across tank types.
- Next phase of development: flight tests with cryogenic tank using FC-72 as test fluid.